(No Model.)

2 Sheets—Sheet 1.

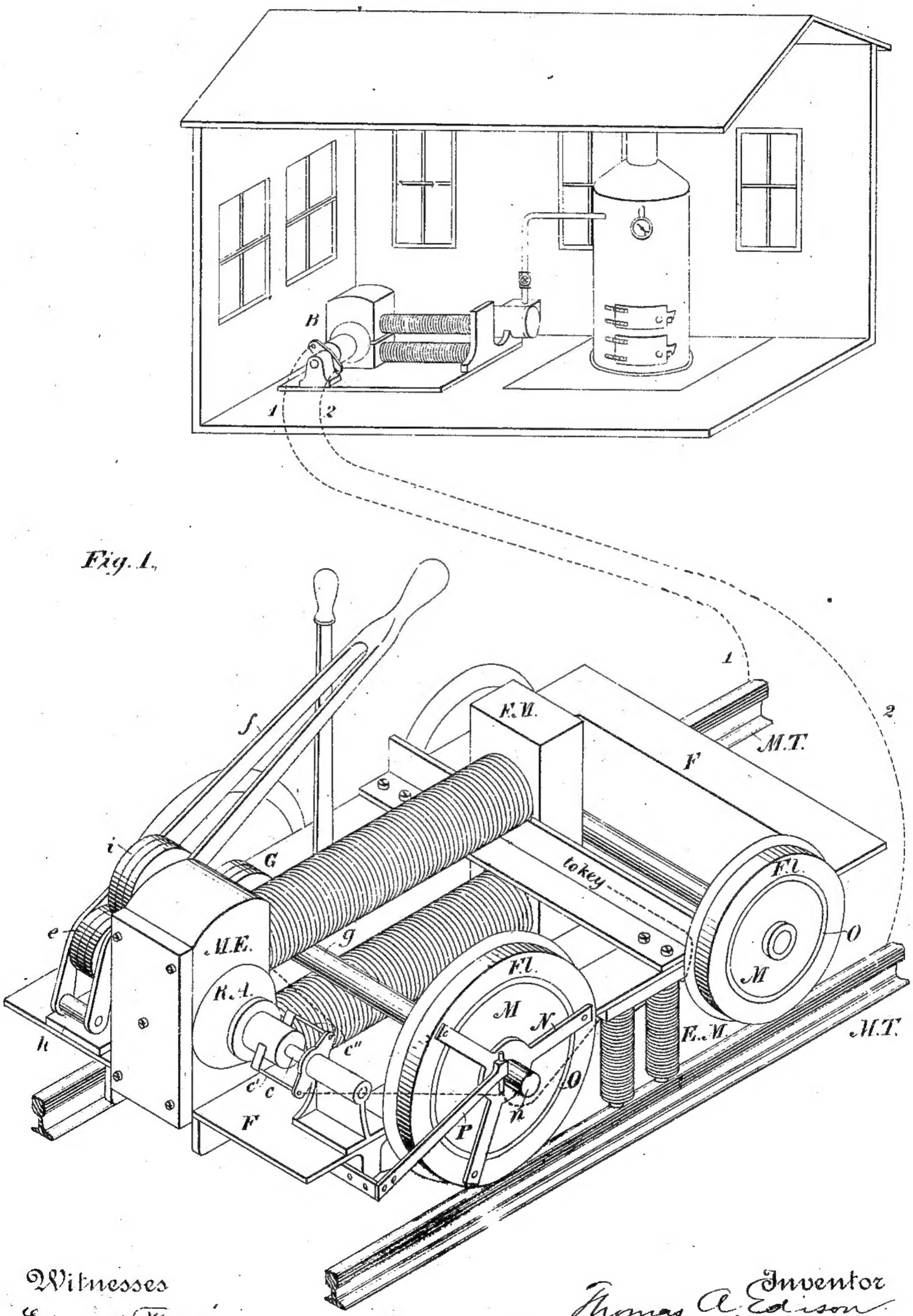
T. A. EDISON.

ELECTRIC LOCOMOTIVE.

No. 475,491.

Patented May 24, 1892.

Fig. 1.



Witnesses
Edward Thorpe.
William Ricks

Inventor
Thomas A. Edison
By his Attorney Wm B. Vansize

(No Model.)

2 Sheets—Sheet 2.

T. A. EDISON.

ELECTRIC LOCOMOTIVE.

No. 475,491.

Patented May 24, 1892.

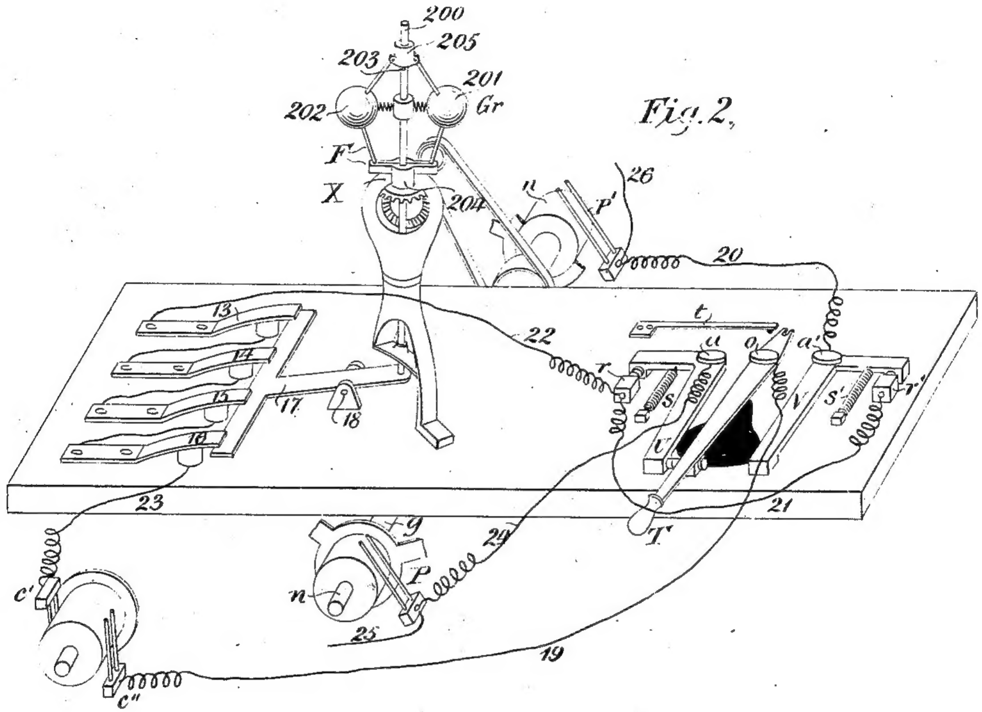


Fig. 2.

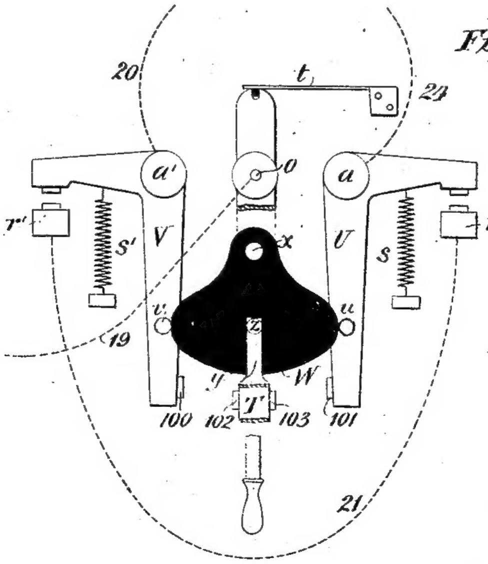


Fig. 3.

Witnesses
Edward Thorpe.
W S Pease

Inventor
Thomas A. Edison,
By his Attorney Wm. B. Vansize.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY, ASSIGNOR TO THE EDISON ELECTRIC LIGHT COMPANY, OF NEW YORK, N. Y.

ELECTRIC LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 475,491, dated May 24, 1892.

Original application filed June 3, 1880, Serial No. 11,243. Divided and application filed May 20, 1882, Serial No. 61,955. Again divided and this application filed June 9, 1891. Serial No. 395,701. (No model.) Patented in England September 25, 1880, No. 3,894; in Canada March 31, 1881, No. 12,568; in India May 3, 1881, No. 341; in Victoria May 12, 1881, No. 3,012; in France May 27, 1881, No. 141,752; in New South Wales June 25, 1881, No. 948; in Queensland June 30, 1881, No. 21/299, and in New Zealand August 2, 1881, No. 542.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Electro-Magnetic Railway Systems, (for which I have received Letters Patent in Great Britain, No. 3,894, dated September 25, 1880; in Canada, No. 12,568, dated March 31, 1881; in India, No. 341, dated May 3, 1881; in Victoria, No. 3,012, dated May 12, 1881; in France, No. 141,752, dated May 27, 1881; in New South Wales, No. 948, dated June 25, 1881; in Queensland, No. 21/299, dated June 30, 1881, and in New Zealand, No. 542, dated August 2, 1881;) and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings and to letters and figures of reference marked thereon.

This application is a division of my application, Serial No. 61,955, filed May 20, 1882, which application was a division of my application, Serial No. 11,243, filed June 3, 1880.

The object of this invention is to furnish an economical system of electro-magnetic railways or tramways which, while useful in any locality, shall be particularly adapted to regions where the traffic is too light for ordinary steam-railways, or where the main bulk of the traffic is limited to certain seasons, or where the difficulties or expense of grading render ordinary steam-roads impracticable.

To this end the invention consists in a complete electro-magnetic-railway system embracing the generation, distribution, and utilization of electric currents as a motive power and in the novel devices and combination of devices therefor, as more particularly described and claimed.

In carrying my invention into effect the rails of the track are electrically connected, so that each line of rails forms one-half of a circuit. For the traveling motor or locomotive an electro-magnetic engine is mounted upon a suitable frame supported upon the axles of the driving and other wheels. This motor is preferably a dynamo-electric machine having its rotating coil and its stationary coil in separate circuits. In order that the circuit from one line of rails to the other be not directly through the wheels and axles, but be through the motor, each car is, so to speak, electrically cut in two by the interposition of insulating material somewhere in its structure, the poles of the motor being connected one to each division. A preferable method is to form the hub and flange of a wheel of separate metallic parts, uniting them by bolting each to a wooden web, which insulates the two, whereby the body of the car and the axles are insulated from the track. Contact-springs bear against the flanges or, preferably, against hubs secured thereto by cross-bars or "spiders," whose outer ends are bolted to the flanges. These contacts are connected to the brushes of the motor, one to each, respectively through the reversing-key hereinafter spoken of. Upon each engine is located a reversing-key, through which the circuit passes to the motor, which may be used as a brake in case of emergency, the reversing of the current acting to reverse the direction of movement of the motor, and thereby more rapidly stop the car. The operative lever of this reversing-key is so combined with a spring that it may be held in a central position without any of its contacts impinging on the other contacts, and so act, also, as a circuit closer or breaker.

In the accompanying drawings I show more in detail how this invention may be carried into effect. It is to be remembered, however, that these details may be varied or equivalents used, and that therefore I do not limit myself generally in such cases to the precise details therein illustrated.

Figure 1 shows the source of electricity, the track, and the vehicle in operating relation. Figs. 2 and 3 are views of the reversing and circuit-breaking key, the latter figure being a view of the bottom thereof.

A is a central station, at which is located a steam boiler and engine, as shown, although the motor may be a water or any other suitable form of motor.

B is a dynamo-electric machine connected with and operated by the motor-engine. The poles of the dynamo are connected with the track-rails by conductors 1 2, as shown. Circuit is formed from one line of rails to the other and the current utilized as a motive agent by an engine constructed as shown in Fig. 1, in which F is any suitable frame-work suspended from the main driving-axle and placed upon the other axle.

The wheels used under the engine-car are constructed as shown. The flange F′ and the hub M are made separately and connected by a wooden web O, to which they are bolted, the wheel then consisting of a metallic hub, a metallic flange, and an intervening wooden or insulating web. By this means the axles and body of the car are insulated from the flanges and track and the current cannot pass therethrough from one rail to the other.

On the engine-car a spider or frame N is secured to the flange F′, so as to be in electrical contact therewith, but not touching or forming contact with the hub M. Upon the center of N is a boss *n*, on which bears a contact brush or arm P. There is a similar device on the opposite end of the axle bearing brush P′.

The reversing and circuit-breaking key is shown in Figs. 2 and 3. U and V are elbow-levers pivoted at *a* and *a′*, respectively, the springs *s* and *s′* tending to cause them to close circuit normally on *r* and *r′*. V is connected to P′ by a conductor, such as 20, and U is connected to P by a conductor, such as 24. *r* and *r′* are fixed contact-stops electrically connected together by a conductor, such as 21, and by conductor 22 to one terminal *c′* of the motor-armature through a number of spring-actuated circuit-breaking points 13 14 15 16, to be hereinafter described. Between the levers U and V is placed the operating-lever T, pivoted at *o* and connected to the other pole *c″* of the motor-engine M E. Upon the under side of T is a pin *z*, taking into a slot *y* in a cam-plate W, pivoted at *x*. The cam-plate W is moved as the lever T is moved by the action of the pin *z* in the slot *y*. It is of such a breadth that when standing in a neutral or untilted position its opposite sides shall take against pins *u v* in levers U and V and force the latter from their contacts, leaving the circuit open. This position is clearly shown in Fig. 3, where the key is seen from its under side. A movement to either side, however, allows one of the levers U V to make contact with *r* or *r′* and the contacts between 100 and 102 or 101 and 103 to be established, as shown in Fig. 2. When one set of contacts is made, the other set is broken, being controlled by the lever T. This lever T when in its intermediate position holds the circuit open at two points *r* and *r′*. There is a notch in its upper end, and there is a spring-arm *t*, having a catch fitted to lodge in the said notch, and thus retain this arm T in this intermediate position, circuit being open, all as shown in Fig. 3. To guard against carelessness or the inattention of the person thus controlling the movement of the car, I provide an automatic switch for opening the motor-circuit whenever the speed of movement exceeds a certain predetermined rate. Upon the car is mounted a centrifugal governor G*r*, driven by a belt from the axle of the car. There is a vertical spindle or rod 200, sliding in bearings, and there are two governor-balls 201 202, arranged in a well-known manner, as shown, to separate upon an increased speed of rotation, and the connection between this vertical rod and the frame carrying the rotating balls is such that as the balls separate under increased speed of rotation the vertical rod 200 is forced downward. This is accomplished by making the jointed frame F, carrying the balls, to rotate freely upon the vertical rod. The lower collar 204 on this frame encircles the said rod, but is held against vertical movement by attachment with the main frame or casting X, while the upper collar 205 on the rod 200 takes against a ring or similar limit-stop 203, fixed to the rod 200. Consequently when the frame F is contracted by the separation of the balls 201 and 202 the rod 200 is forced downward. The rod is lifted by the lever 17 under spring influence. These four springs or spring-fingers 13, 14, 15, and 16 are normally in contact with four fixed contact-stops. Spring 13 is electrically connected by wires 22 and 19 through the manually-operated circuit-changer T with one terminal of the armature *c″*, the fixed contact of spring 13 is electrically connected with spring 14, the fixed contact of spring 14 is connected to spring 15, the contact of spring 15 is connected to spring 16, and the stop of spring 16 is connected by wire 23 to the terminal of the armature-circuit *c′*. It will thus be seen that the several springs and contact-stops are in circuit in series and that the cross-bar attached to pivoted lever 17 is in position to simultaneously lift all of these springs from their contacts and so break the circuit at several points. This makes a division of the sparking due to breaking the circuit, and the spark at any break-point is therefore comparatively small.

g is the main driving-axle, upon which is mounted friction-wheel G. Upon the shaft *c* of the magnetic engine is a friction-pulley *e*, the pulley *e* and G not being in contact normally. In a swinging frame *f*, pivoted at *h*, is mounted a friction-pulley *i*. The frame *f* being depressed bears upon *e* and G and communicates motion from *e* to G, the percentage transferred being proportioned to the frictional contact of *i* upon *e* and G.

In the operation of this railway, current generated at A is conducted through the rails of the track to the moving vehicle, thence, *via* F′ N *n* P 24 U 101 103 T 19 *c″* and armature-coils *c″* 23 16 15 14 13 22 *r* 21 *r′* V 20 to P′ and through the wheel and rail on the opposite side of the car, the motor acting to propel the car. If now the lever T be moved to a central position, so that *t* catches and holds it, as described, circuit will be open at points *r r′* and the motor will stop. If the lever T is moved to the limit of its movement opposite to that shown in the drawings, circuit will be *via* elements F' N n P 24 U r 22 13 14 15 16 23 c' and armature-coils c'' 19 T 102 100 20 P' to opposite car-wheel and track-rail from that by which it entered. The direction of current through the motor is reversed with respect to that first described and the direction of movement of the armature is reversed. This acts to brake the vehicle, which will first come to a stop, and if the reversed current be maintained the car will travel backward. If at any time the speed of movement becomes too rapid and if the operator controlling the car fails to check the rapid advance by manipulating the switch-lever T, the rotation of the governor G*r* will depress lever 17 and the springs 13 14 15 16 will be lifted from the contacts upon which they normally rest, thus breaking the circuit at several points, and by this means obviating the injurious sparking incident to breaking a heavy current of electricity, and the motor being cut off from its supply of current at these break-points will slow down until the retardation of the governor G*r* allows springs 13 14 15 16 to resume their normal position.

I do not herein claim, in an electro-magnetic railroad-engine, the combination, with the electric motor mounted thereon and the driving-wheels thereof, of means for connecting or disconnecting the two at will, whereby the engine may be stopped by withdrawing the power from the driving-wheels without stoppage of the motor, as that is claimed in another application, Serial No. 305,700, filed June 9, 1891.

Any patentable subject-matter herein shown or described but not claimed forms the subject-matter of my pending applications, Serial No. 11,243, filed June 3, 1880, and Serial No. 61,955, filed May 20, 1882, or the divisions thereof, serially numbered 395,700, 395,702, 395,703, 395,704, 395,705, filed June 9, 1891.

What I claim, and desire to secure by Letters Patent, is—

1. An electric railway having, in combination, the following elements, to wit: a stationary dynamo-electric generator, a wheeled vehicle traveling upon rails, an electro-dynamic motor mounted upon such wheeled vehicle, having its field and armature coils in separate circuits, electrical connections between the motor upon the vehicle and said generator, and controlling devices mounted upon said wheeled vehicle for starting, stopping, and reversing its movement, whereby the movement of the wheeled vehicle can be completely controlled by a person riding thereon, substantially as set forth.

2. In an electric railway, the combination of a stationary dynamo-electric machine, a wheeled vehicle traveling upon rails, an electro-dynamic motor upon said vehicle, electrical connections between said motor and said dynamo-machine, a manually-operated controlling device upon the vehicle for starting, stopping, or reversing the movement of the motor, whereby the movement of said vehicle may be controlled by a person riding thereon, and an automatic circuit-breaker in the motor-circuit, operated by variations in the speed to reduce the speed of the car whenever it exceeds a predetermined maximum, substantially as described.

3. In an electric railway, the combination of a stationary dynamo-electric machine, a wheeled vehicle traveling upon rails, an electro-dynamic motor located upon said vehicle, by which it is propelled, electrical connections between said motor and said dynamo, a switch for reversing the direction of current in said motor, and a circuit-breaker to vary the current in said motor, automatically operated by a mechanical connection between a rotating part of the vehicle and a rotating part of the circuit-breaker, substantially as described.

4. In an electric railway, the combination of a stationary dynamo-electric machine, a wheeled vehicle traveling upon rails, an electro-dynamic motor located upon said vehicle, by which it is propelled, electrical connections between said motor and said dynamo, and a circuit-breaker in the motor-circuit located on the car, having a number of contact-points connected in series with each other, whereby sparking at the break-points is obviated, substantially as described.

5. In an electric railway, the combination of a stationary dynamo-electric machine, a wheeled vehicle traveling upon rails, an electric motor on the vehicle, electrical connections between said motor and said dynamo, a controlling device on the vehicle for starting, stopping, and reversing its movement, and means for automatically varying the speed of movement, all arranged substantially as described.

6. The combination, with an electric motor mounted upon and actuating the car, of the main driver-axle, a governor receiving motion from the latter, and a circuit-breaker arranged to break or close the circuit at a number of points controlled by the governor, all operating to break the circuit of the motor simultaneously at several points upon the attainment of a predetermined rate of speed and avoid or reduce sparks in so doing, substantially as set forth.

THOMAS A. EDISON.

Witnesses:
THOMAS MAGUIRE,
JOHN F. RANDOLPH.